PATENT SPECIFICATION

996,386

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Date of filing Complete Specification: November 17, 1961.

Application Date: November 29, 1960. *No. 40904/60*

Complete Specification Published: June 30, 1965.

Index at Acceptance:—**F2 E** (1A1B, 1A1D2, 1A1X1, 1A1X4, 2N1A1, 2N1A4A2, 2N1A5, 2N1C2B, 2N1D2C, 2N1D2D, 2N1D3B, 2N1D5, 2N1D6B, 2N1D6C5, 2N1D10, 2N1D12, 2N1D13, 2N1E5).

Int. Cl.:—F 06 d.

COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Improvements in Disc Brakes

WE, DUNLOP RUBBER COMPANY LIMITED, a British Company of 1, Albany Street, London, N.W.1., do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement :—

This invention relates to disc brakes and more particularly relates to improvements in disc brakes of the kind comprising a rotatable disc and a non-rotatable housing straddling the outer periphery of the disc and covering a minor portion only of the braking surfaces thereof.

In disc brakes of this kind the housing usually comprises a caliper provided with means for locating pads of friction material and guiding them in axial directions towards and away from the disc and hydraulically-operated piston and cylinder mechanisms associated with the caliper on both sides of the disc to force said pads into frictional engagement with the disc.

It is possible to make the housings in one piece with the operating cylinders formed integrally therewith in which case the cylinders must be bored from one end which must subsequently be plugged. This arrangement, which can provide a stiff and rigid assembly, nevertheless has a number of disadvantages and is not now widely adopted. Alternatively the housing may be formed in, e.g. two parts each of which has a cylinder formed therewith and the parts may be bolted together after machining. In yet a further alternative the caliper is made in one piece and the cylinders are subsequently bolted to it. These latter two alternatives overcome the machining problems inherent in a one-piece housing of the type hitherto known but, due to their fabricated construction, have the disadvantage that the limbs of the caliper deflect axially-outwardly away from the disc when the brake is applied, giving unfavourable braking characteristics.

The object of the present invention is to provide an improved disc brake wherein these disadvantages are overcome. A further object of the invention is to provide a housing for such a disc brake.

According to the present invention a disc brake comprises a rotatable disc, a non-rotatable housing straddling a periphery of the disc and having a pair of limbs one on each side of the disc, a pair of friction elements associated one with each limb of the housing and movable into frictional engagement with opposite sides of the disc, and brake-applying means for effecting the said frictional engagement, the brake-applying means comprising a pair of cylinders and pistons, one cylinder and piston being associated with each limb, each of the cylinders being formed in its respective limb as a blind bore the open end of which is presented towards the disc and the axes of the cylinders being inclined relative to the braking surfaces of the disc, the angle between the axes of the cylinders being so chosen and the cylinders being so positioned in the housing that the projected periphery of each cylinder along its axis is clear of the limb on the opposite said of the disc.

According to the invention also a disc brake comprises a rotatable disc, a non-rotatable housing straddling a periphery of the disc and having a pair of limbs one on each side of the disc, a pair of friction elements associated one with each limb of the housing and movable into frictional engagement with opposite sides of the disc, and brake-applying means for effecting the said frictional engagement, the brake-

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applying means comprising a pair of cylinders and pistons, one cylinder and piston being associated with each limb, each of the cylinders being formed in its respective limb as a blind bore the open end of which is presented towards the disc and the axes of the cylinders being inclined relative to the braking surfaces of the disc, the angle between the axes of the cylinders being so chosen and the cylinders being so positioned in the housing that the projected periphery of each cylinder along its axis is clear of the limb on the opposite side of the disc, and guide means being provided to support each of the friction elements in a position closely adjacent the associated braking surface of the disc.

In one preferred embodiment the friction elements each comprise a pad of friction material having a backing plate secured thereto and are adapted each under the influence of a piston and cylinder mechanism, to move along the axes of their associated cylinders and are supported to a position closely adjacent the braking surfaces of the disc by guide means. The whole or part of the guide means is detachable from the housing to permit removal of the pad assemblies and a layer of low friction and electrically inert material may be interposed between the pad and the guide means.

In another preferred embodiment a pair of pressure members carrying pad assemblies are pivotable at one end of the housing, extend chordally across the disc and are angularly movable about their pivots when urged by pistons in abutment with them to frictionally engage the pads with the disc. The ends of the pressure members may project beyond the periphery of the disc and may be moved angularly towards the disc by mechanical means to provide an auxiliary brake such as a hand brake.

According also to the present invention a housing for a disc brake comprises a pair of integrally united limbs set at an angle to one another, said angle being adapted to be bisected by the plane of an associated disc, each said limb having a blind cylinder formed therein, the open ends thereof being presented towards one another and so positioned that each cylinder may be machined from its open end without interfering with the remainder of the housing.

As suggested above, a housing of this kind can form the basis of a number of disc brake embodiments.

A description of three such embodiments of disc brakes to which the present invention is applied follows with reference to the accompanying drawings.

Figure 1 is a part-sectional elevation of a first variation of disc brake;

Figure 2 is a view in the direction of the arrows on the section A-A of Figure 1;

Figure 3 is a view of a caliper-type housing in the direction of arrow D of Figure 1;

Figure 4 is a side elevation of a second variation of disc brake;

Figure 5 is a sectional elevation in the direction of the arrows on the section B-B of the brake of Figure 4;

Figure 6 is a plan view of a caliper-type housing viewed in the direction of arrow E of Figure 4;

Figure 7 is a similar section to Figure 5 and shows a brake of a similar type to that shown in Figures 4, 5 and 6;

Figure 8 shows a friction pad assembly as used in the brake of Figure 5 and viewed in the direction of the arrow F.

In the embodiment illustrated with reference to Figures 1, 2 and 3 a disc brake comprises a rotatable disc 1 and a caliper-type housing 2 having two limbs 3 set at an angle of approximately 60° which is bisected by the disc 1. One of the limbs 3 is provided with an extension 3*a* having holes 3*b* therein for securing the brake. A curved web 4 of metal extends substantially axially adjacent the outer periphery of the disc 1 and joins the lambs 3 integrally. Each limb 3 is provided with a cylinder 5 formed therein, the alignment of each cylinder being such that the projection of each cylinder 5 along its axis and towards the disc does not intersect the limb 3 on the other side of the disc.

By suitably mounting the caliper an appropriate tool can be arranged to machine each cylinder without touching the opposite limb.

A piston 6 is fluid-tightly slidable in each cylinder 5 and each piston abuts a sloping side 7 of a pressure member 8 which is pivotally and detachably secured at one end to a limb 3 of the caliper housing 2 adjacent the periphery of the disc 1. Each pressure member 8 has a pad 9 of friction material secured thereto to form a friction element and the said members 8 extend chordally across the braking surfaces of the disc 1 and project beyond the periphery thereof and are united adjacent said periphery by an operating rod 10 having a lever 11 associated therewith.

Each pressure member 8 is formed at its inner end with a recess 13 presented towards the web 4. A socket headed screw 14 passes through the web 4 and has a domed end 15 which engages the recess 13 and forces the opposite face of the pressure member 8 into abutment with a convex part 16 of a spring clip member 17. Projections 18 to which the spring clip members 17 are secured protrude from the limbs 3.

The operating rod 10 at one end is con-

nected to one pressure member 8 at the projecting end thereof by means of a head 19 domed on the underside to engage a complementary recess in the pressure member, and at the other end is screwed into a trunnion block 11*a* mounted adjacent one end of the lever 11 which is bifurcated at this point. The rod 10 passes freely through a hole 20 formed in the other of the pressure members 8. The lever 11 and the adjacent pressure member 8 lie closely alongside each other and are adapted to abut at the extreme free end of the member 8 on angular brake-applying movement of the lever. The end of the lever 11 remote from the trunnion block end is provided with a hole for a brake actuating cable.

Movement of the pistons against the pressure members 8 under the effect of hydraulic pressure causes the pads 9 to be urged into frictional engagement with the braking surfaces of the disc 1. Alternatively angular movement of the lever 11 by the actuating cable referred to causes the pressure member 8 adjacent thereto to be pressed towards the disc and the operating rod to draw the opposite pressure member towards the disc so that the pads of both pressure members frictionally engage the braking surfaces.

The brake pads 9 can be renewed by withdrawing the socket headed screws and removing the pressure members 8 and lever assembly from the caliper housing 2 when they will be readily accessible.

Figures 4, 5 and 6 show a brake wherein the friction pads move axially of the associated cylinders towards and away from the disc. The caliper housing shown in Figure 6 is similar to that shown in Figure 3 in that it comprises a pair of limbs 3 extending radially inwardly from the outer periphery of the disc 1 on each side thereof and joined together by a web 4.

The cylinders 20 of this brake are formed in a similar manner to the cylinders 5 of Figure 1; that is they are positioned so that they can be machined without fouling the opposite limb. An inlet connection 21 and entry ports 22 are formed in the lower part of the brake as shown in Figures 4 and 5 and a bleed screw 23 is provided in the uppermost part of each cylinder to permit filling of the cylinder with hydraulic fluid. A piston 24 fluid-tightly slidable in the cylinder 20 has a pip 25 on its forward face which is engageable with a complementary depression 26 in a thrust member or backing plate 27 of a friction pad 28, the member 27 and pad 28 together constituting a friction element. Since the cylinder 20 is angled to the plane of the disc and the pad 28 moves axially of the cylinder it follows that the braking face of the pad 28 is angled so that it meets the braking surface of the disc 1 over its whole face. The pad 28 is guided to and from the disc by the walls of the cylinder 20 on one side and by a brake torque member 29 bolted to the limb 3 at two spaced locations. The member 29 is chamfered so that it is complementary to the adjacent side of the brake pad which is flattened on its uppermost side as seen in Figures 5 and 8.

A layer 28*a* of low friction material is bonded to this side of the pad 28 so that there will be no undue restriction on movement of the pad towards the disc. The material of the pad 28 is of necessity a high friction material and the normal pressure across the interface of the pad and the brake torque-carrying guide member 29 would cause a high frictional force tending to prevent the movement of the pad 28 towards or away from the disc 1. By interposing a suitable layer 28*a* of plastic or other low friction material the frictional force is reduced considerably and an easier movement of the pad 28 towards the disc 1 is possible. The layer 28*a* may alternatively be secured to the member 29 to provide a low friction surface against which the friction pad is slideable.

It can also be arranged that the layer 28*a* is of electrically inert material as well as having low friction properties. It then prevents the occurrence of electrolytic corrosion due to differences in potential between metal or graphite particles in the pad and the metal of the member 29 when the member 29 is made of metal such as is usually the case.

When the cylinders 20 are pressurised each piston 24 and associated pad 28 moves to effect braking engagement of the pad and disc. Moreover, due to the angle at which the pads meet the disc, a considerable self-wrapping or servo effect is obtained when the disc rotates in the direction indicated by the arrows in Figures 4, 5 and 7.

Pad removal is effected by unbolting the members 29 and withdrawing pads 28 through the aperture so produced.

In a third embodiment illustrated in Figure 7 most of the members described with reference to Figures 4, 5 and 6 are present, the difference being that the members 29 are replaced by a pair of stirrup shaped members 30, lying within the caliper housing 2. These support the brake pads 31 to a position closely adjacent the braking surface of the disc 1. The stirrup shaped members 30 have apertures 32 to guide the pads 31 towards the disc 1 and at their tapering ends 33 are bolted to a limb 3 adjacent the web 4 by bolts 34.

Removal of the bolts 34 allows both the members 30 to be withdrawn together with the friction elements which comprise the pads 31 and thrust members or backing

plates 35 attached thereto. Dovetail joints or other means may be used to detachably secure the pads 31 and thrust members 35 together.

Brakes of the kind described are easily machined and assembled and are thus economical to produce. Since the caliper housing is made in one piece it is very strong and robust and deflections caused by limb separation when the brake is applied are of a very low order, thus improving braking characteristics.

In the construction of brake described with reference to Figures 1, 2 and 3 the pressure members are acted upon by the pistons and are not subject to large bending forces when the brake is hydraulically operated. The volumeric displacement of hydraulic fluid is also reduced to a minimum in this type of brake. This has the advantage that the difference in pedal travel between the new and fully worn conditions of the pads is not excessive.

The brakes described herein and particularly those brakes described with reference to Figures 4-7 are normally provided with spring means (not illustrated) to effect separation of the pads and disc when the brake is idle. In addition an adjusting mechanism may be fitted to ensure that the stroke of the piston remains the same despite wear of the pads.

The brakes described with reference to Figures 4-7 are basically of the kind described in British Patent Specification No. 767,099 but the construction of the caliper is different in the present case.

Having regard to the provisions of Section 9 of the Patents Act 1949, attention is directed to the claims of Patent No. 767,099.

WHAT WE CLAIM IS:—

1. A disc brake comprising a rotatable disc, a non-rotatable housing straddling a periphery of the disc and having a pair of limbs one on each side of the disc, a pair of friction elements associated one with each limb of the housing and movable into frictional engagement with opposite sides of the disc, and brake-applying means for effecting the said frictional engagement, the brake-applying means comprising a pair of cylinders and pistons, one cylinder and piston being associated with each limb, each of the cylinders being formed in its respective limb as a blind bore the open end of which is presented towards the disc and the axes of the cylinders being inclined relative to the braking surfaces of the disc, the angle between the axes of the cylinders being so chosen and the cylinders being so positioned in the housing that the projected periphery of each cylinder along its axis is clear of the limb on the opposite side of the disc.

2. A disc brake comprising a rotatable disc, a non-rotatable housing straddling a periphery of the disc and having a pair of limbs one on each side of the disc, a pair of friction elements associated one with each limb of the housing and movable into frictional engagement with opposite sides of the disc, and brake-applying means for effecting the said frictional engagement, the brake-applying means comprising a pair of cylinders and pistons, one cylinder and piston being associated with each limb, each of the cylinders being formed in its respective limb as a blind bore the open end of which is presented towards the disc and the axes of the cylinders being inclined relative to the braking surfaces of the disc, the angle between the axis of the cylinders being so chosen and the cylinders being so positioned in the housing that the projected periphery of each cylinder along its axis is clear of the limb on the opposite side of the disc, and guide means being provided to support each of the friction elements in a position closely adjacent the associated braking surface of the disc.

3. A disc brake according to claim 2 wherein at least part of the guide means is detachable to permit removal of the associated friction element.

4. A disc brake according to claim 2 wherein the whole of the guide means is detachable and on removal from the housing carries its associated friction element with it.

5. A disc brake according to claim 4 or claim 4 wherein the friction element comprises a pad of friction material and a thrust member or backing plate, the braking face of said pad being so angled with respect to its own direction of movement as to engage the associated braking face of the disc in face to face contact.

6. A disc brake according to claim 5 wherein a layer of low friction material is interposed between a surface of the pad and that part of its associated guide means which normally carries the braking torque.

7. A disc brake according to claim 6 wherein said layer of low friction material is secured to said surface of the pad or to said associated guide means.

8. A disc brake according to claim 6 or claim 7 wherein said guide means is metal and said layer is made of electrically inert material to prevent electrolytic corrosion between electrically conducting inclusions in said pad and said guide means.

9. A disc brake according to claim 1 wherein a pair of pressure members carrying friction pad assemblies are pivotable about one end thereof on the housing one on each side of the disc and are angularly movable towards the disc each by an abutting piston.

10. A disc brake according to claim 9

wherein said pad assemblies are secured to said pressure members intermediate their ends.

11. A disc brake according to claim 10 wherein the ends of said pressure members remote from said housing extend chordally and project beyond the periphery of said disc and are connected together by mechanical brake actuating means.

12. A disc brake according to claim 11 wherein said mechanical brake actuating means comprises an operating rod connected at one end to a projecting end of one pressure member and at the other end to a lever member adjacent the ends of the latter, said lever member being pivoted at one extreme end on the projecting end of the other of said pressure members and having a control cable or the like attached to the opposite end whereby upon angular movement of said lever member both said pressure members are urged towards the disc.

13. A disc brake according to any one of claims 9-12 wherein the ends about which the pressure members move are provided with recesses and screwed members which threadably engage the housing are provided with domed ends which engage the recesses in the pressure members and provide pivot points therefor.

14. A housing for a disc brake comprising a pair of integrally united limbs set at an angle to one another, said angle being adapted to be bisected by the plane of an associated disc, each said limb having a blind cylinder formed therein, the open ends thereof being presented towards one another and so positioned that each cylinder may be machined from its open end without interfering with the remainder of the housing.

15. A disc brake constructed and arranged substantially as described herein and illustrated with reference to Figures 1 and 2 of the accompanying drawings.

16. A disc brake constructed and arranged substantially as described herein and illustrated with reference to Figures 4 and 5 of the accompanying drawings.

17. A disc brake constructed and arranged substantially as described herein and illustrated with reference to Figure 7 of the accompanying drawings.

18. A housing for a disc brake constructed and arranged substantially as described herein and illustrated in Figure 3 or Figure 6 of the accompanying drawings.

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Agent for the Applicants.

Berwick-upon-Tweed: Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd.—1965
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2 from which copies may be obtained.

996,386 COMPLETE SPECIFICATION
5 SHEETS

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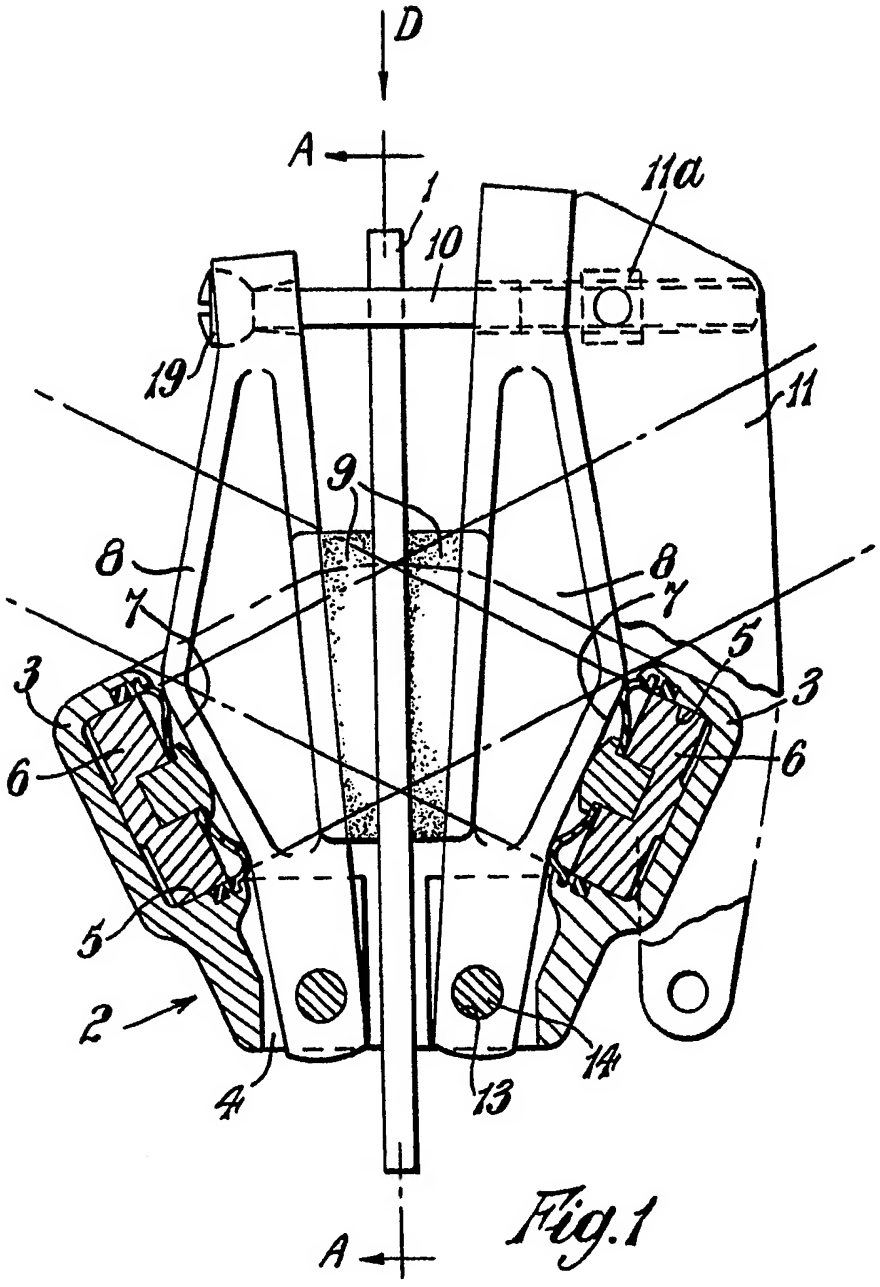

Fig. 1

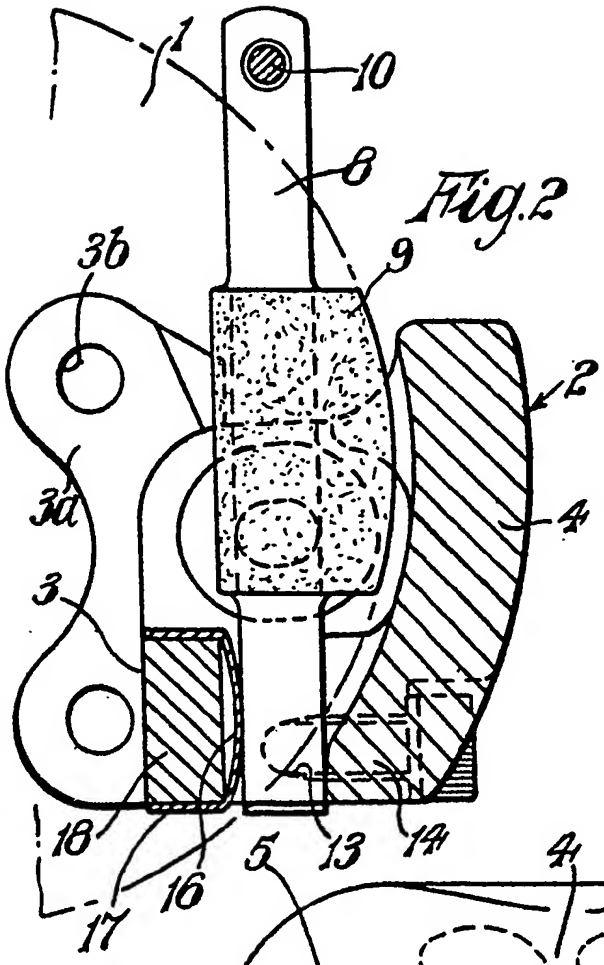

Fig.2

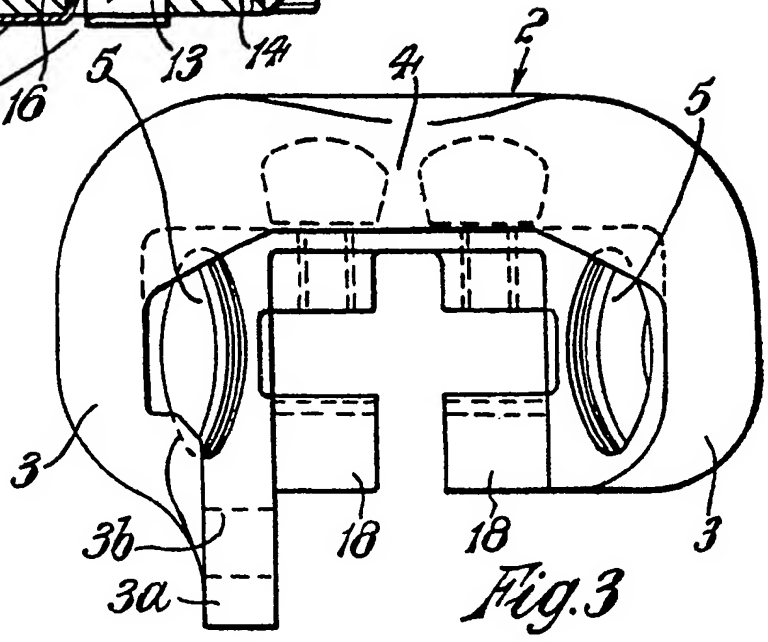

Fig.3

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SHEETS 2 & 3

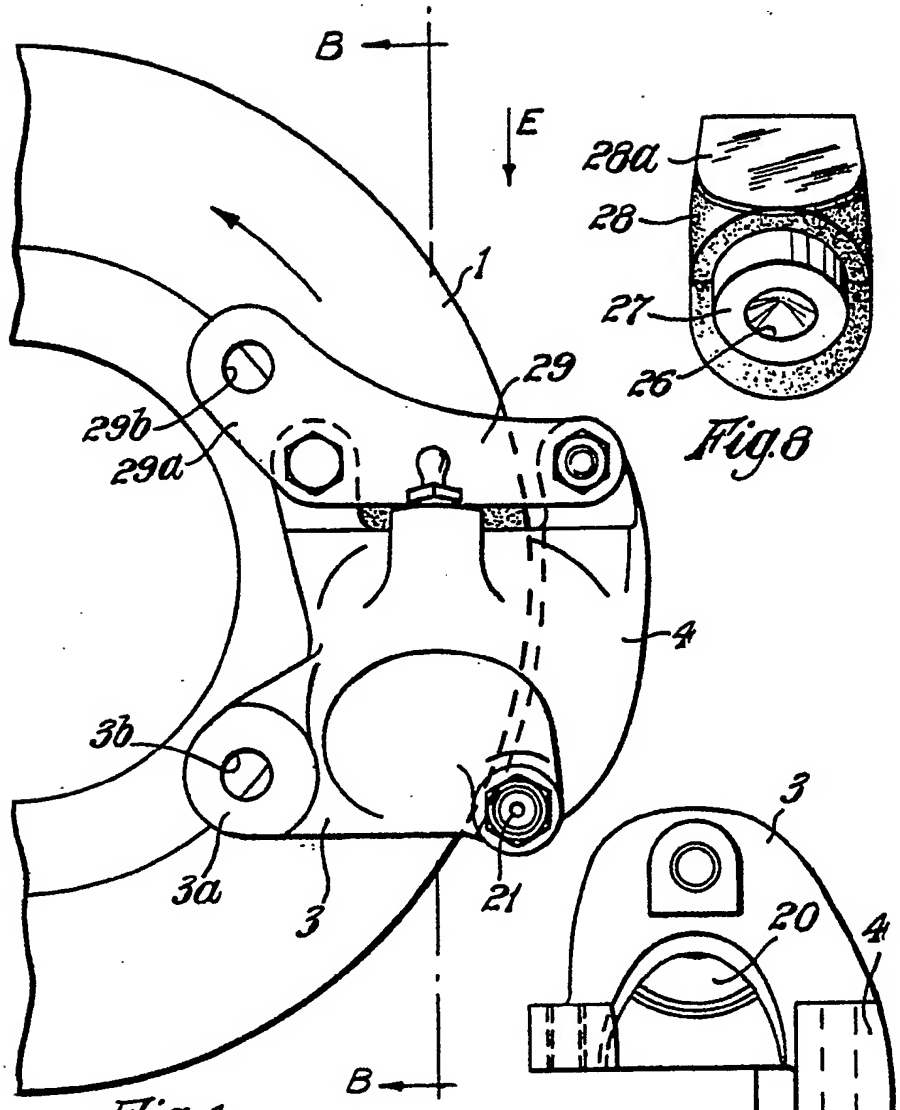

Fig.4

Fig.6

Fig.6

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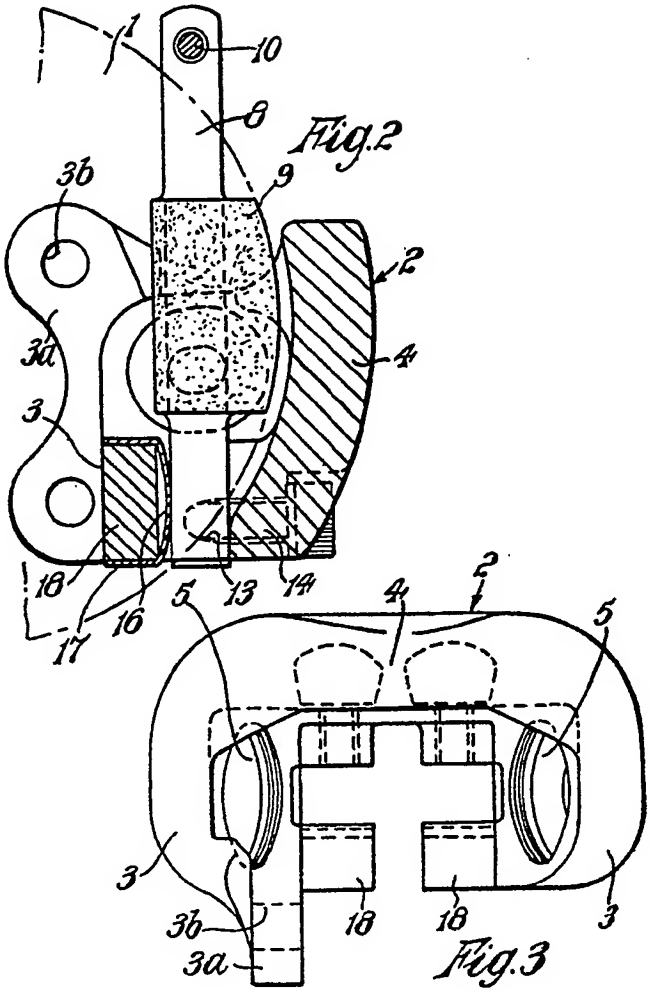

Fig.2

Fig.3

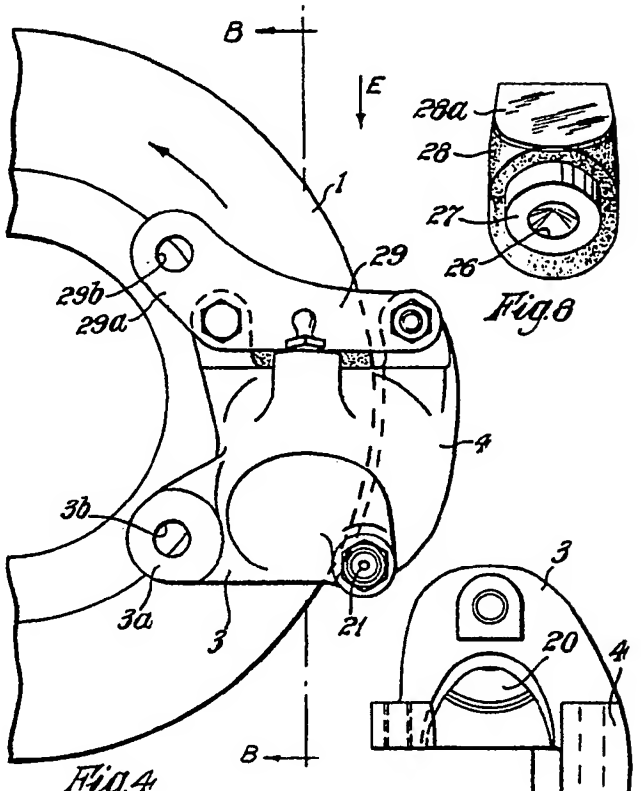

Fig.4

Fig.8

Fig.6

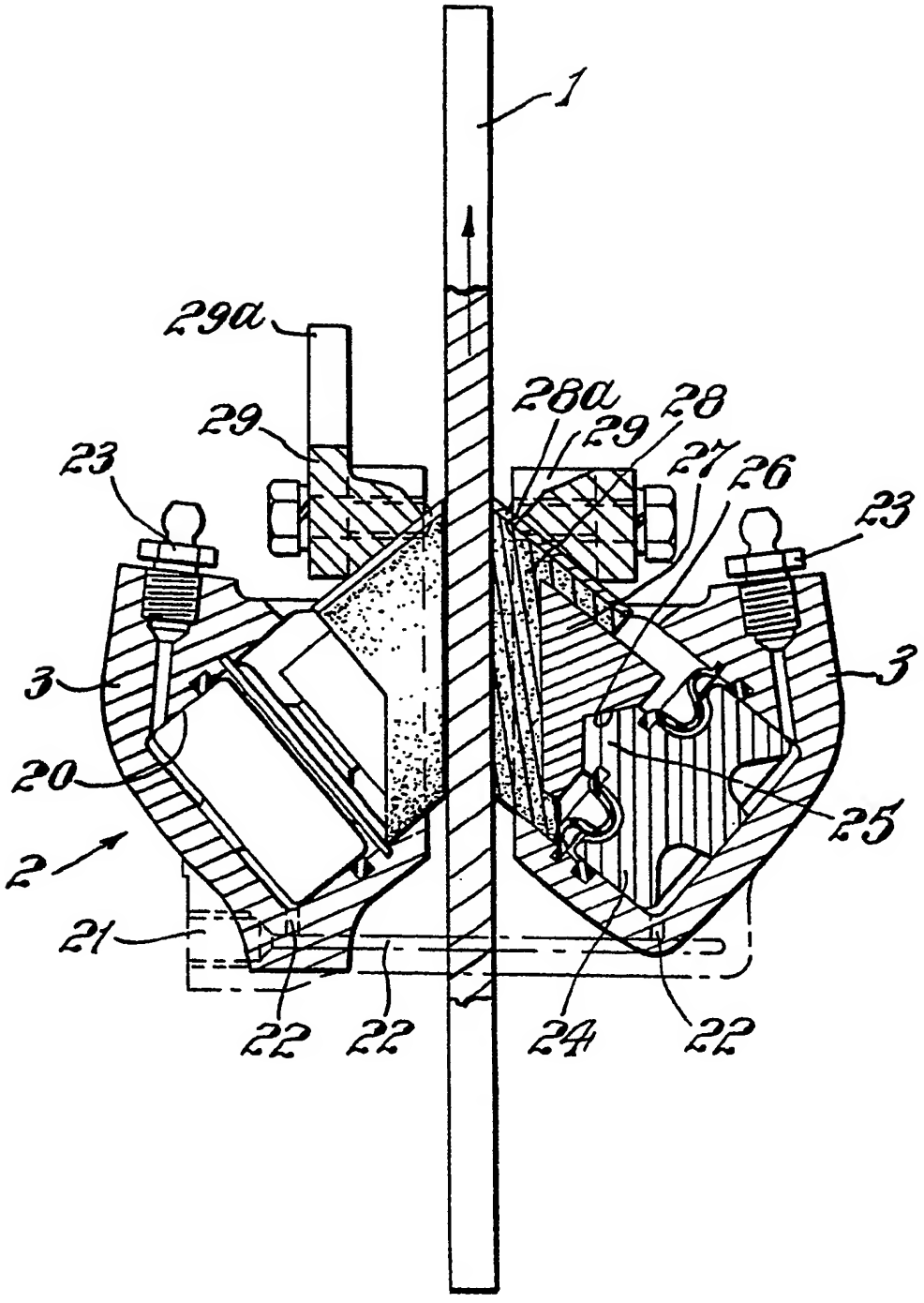

Fig.5

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SHEETS 4 & 5

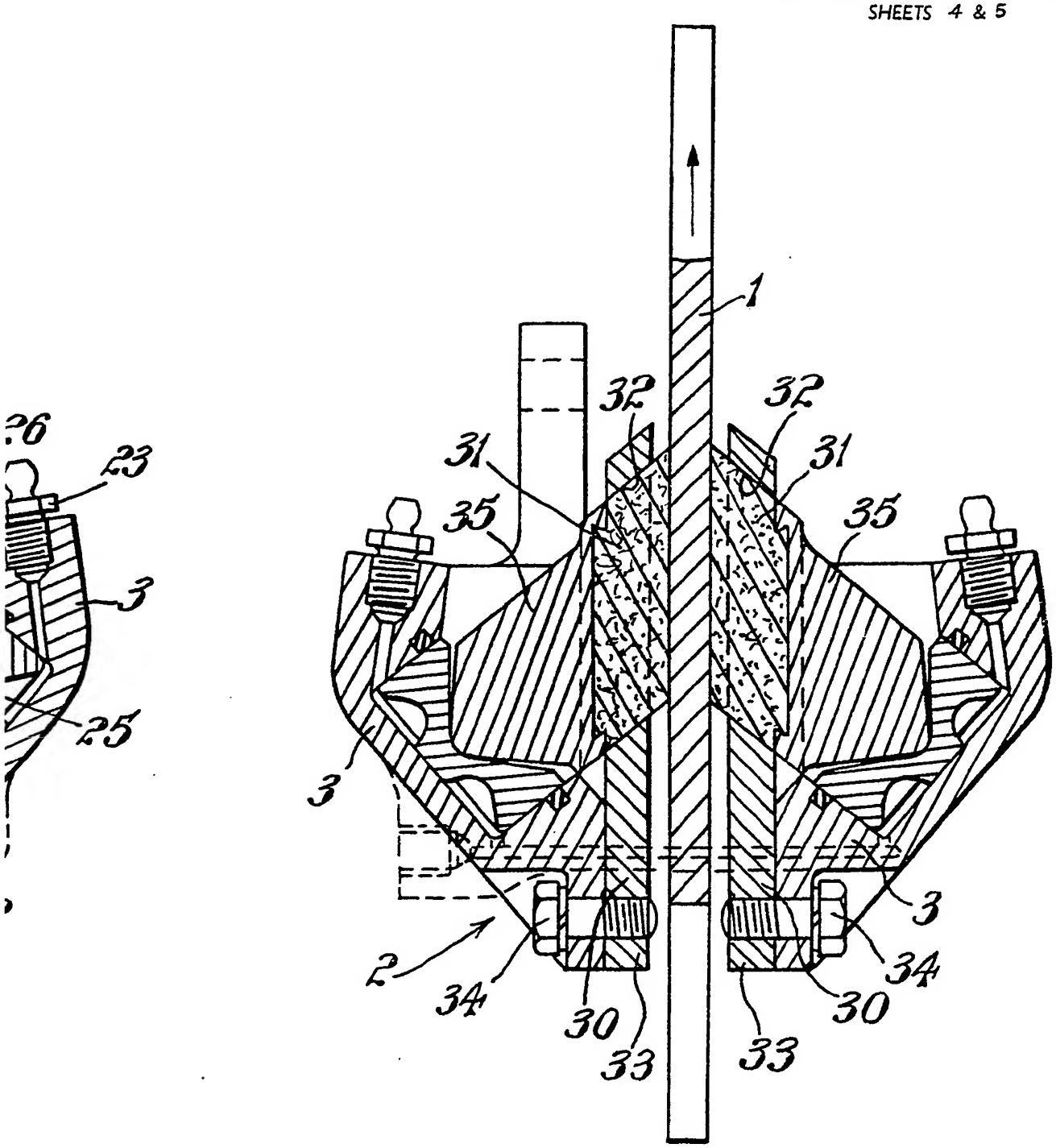

Fig. 7

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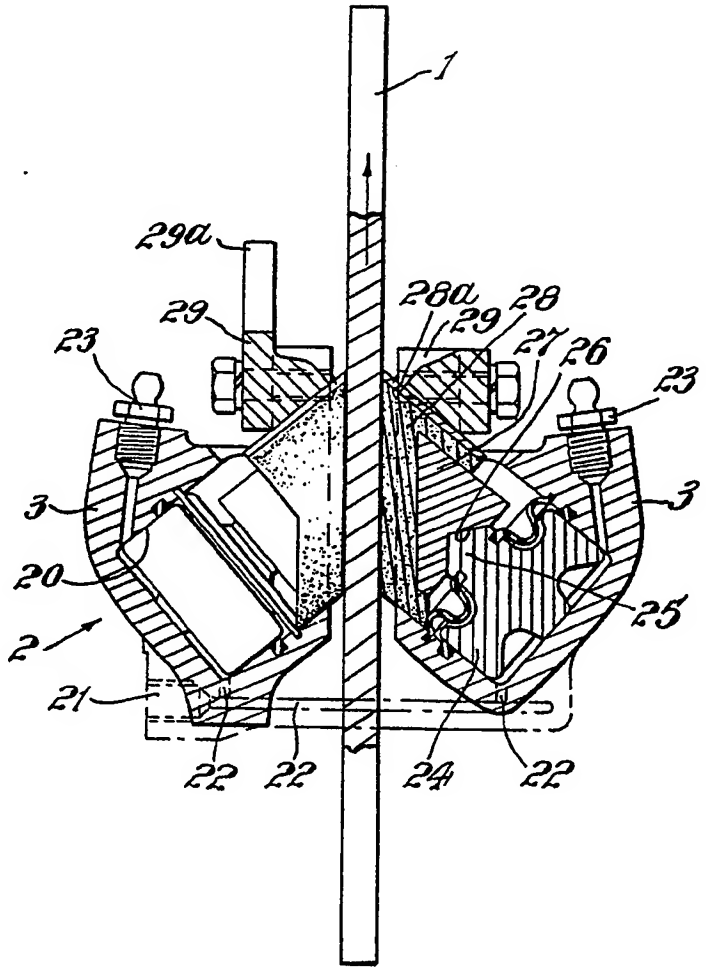

Fig.5

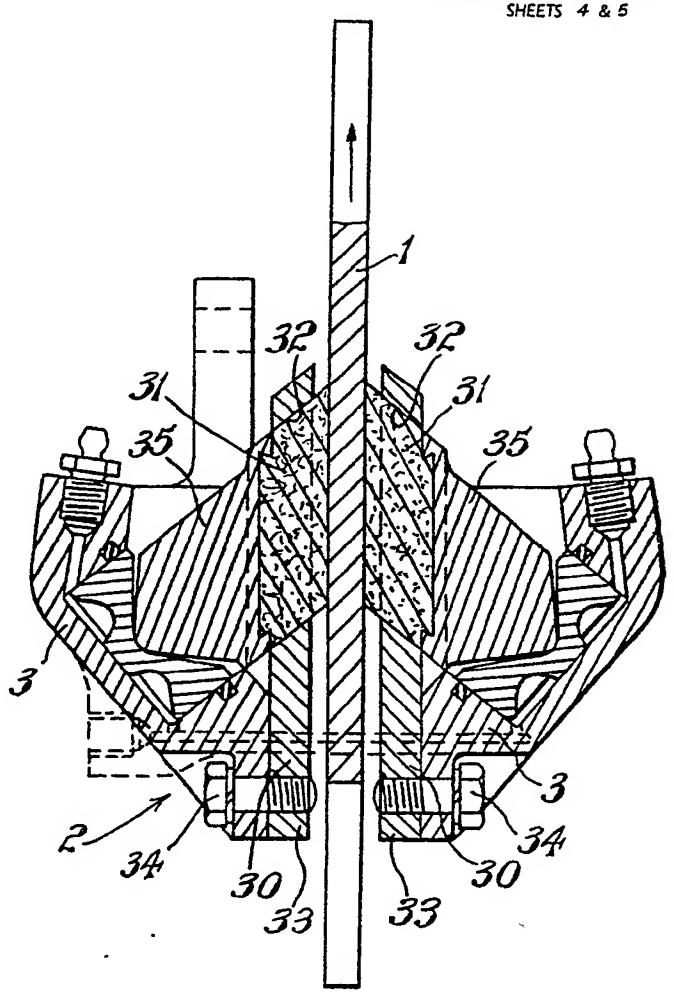

Fig.7